CLAIMS

What is claimed is:

1   1. A system for obtaining at least one calibration
2   profile for an image scanning apparatus, the system
3   comprising:

4   a light source;

5   a calibration image having a surface illuminated by the
6   light source;

7   a detector to measure an intensity of light obtained from
8   a plurality of points on the calibration image;

9   a first memory to store a first plurality of light
10   intensity values measured by the detector at each of the
11   points; and

12   a smoothing module to smooth the plurality of light
13   intensity values in the first memory so as to form a
14   calibration profile.

1   2. A system as recited in claim 1, further comprising a
2   value corrector to correct a second plurality of light
3   intensity values measured by the detector for the light
4   obtained from an arbitrary image at each of the points
5   using the calibration data.

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1   3.   A system as recited in claim 1, wherein the
2   calibration image has uniform reflectivity across the
3   surface

1   4.   A system as recited in claim 1, wherein the smoothing
2   module is useful to employ filtering.

1   5.   A system as recited in claim 1, wherein the smoothing
2   module is useful to employ extrapolation and decimation
3   upon data of a subset of the plurality of points.

1   5.   A system as recited in claim 4, wherein the filtering
2   includes multirate filtering.

1   6.   A system as recited in claim 1, wherein the detector
2   is also useful to measure an intensity of light obtained
3   from a dark image at the plurality of points, and the
4   first memory is to also store a plurality of black
5   intensity values measured by the detector at each of the
6   points to form a black calibration profile.

1   7.   A system as recited in claim 6, wherein the smoothing
2   module is also useful to smooth the plurality of black
3   intensity values in the first memory.

1   8.   A system as recited in claim 7, wherein the smoothing
2   module is useful to employ extrapolation, filtering and
3   decimation upon data of a subset of the plurality of
4   points.

1   9.   A system for scanning images, the system comprising:

2   means for providing light;

3   means for measuring at a number of points on a
4   transparent object, the intensity of light emitted from
5   the means for providing light transmitted through the
6   transparent object to form a first raw profile; and

7   means for smoothing the first raw profile to form a
8   calibration profile.

1   10.   A system for scanning images as recited in claim 9,
2   further comprising:

3   means for measuring the intensity of light from the light
4   transmitted through an opaque object at the number of
5   points to form a second raw profile; and

6   means for smoothing the second raw profile to form a
7   black calibration profile.

1   11.   A system for scanning images as recited in claim 9,
2   further comprising:

3   means for measuring the intensity of light from the light
4   transmitted through a semi-transparent object at the
5   number of points to form a semi-transparent object
6   profile; and

7   means for correcting the semi-transparent object profile
8   using the calibration profile.

1   12. A system for scanning images as recited in claim 11,
2   further comprising means for correcting the semi-
3   transparent object profile using the black calibration
4   profile.

1   13. A method for improving an initial calibration
2   profile having an initial profile extent to form an
3   improved calibration profile, the initial calibration
4   profile formed for a scanner employing a linear array CCD
5   and having a direction of motion, the method comprising:

6   forming for the initial calibration profile an
7   extended profile extent in the direction of
8   motion using quadratic extrapolation;

9   applying multirate filtering to the extended
10   profile to form a filtered profile; and

11   truncating the filtered profile to bring it to
12   the initial profile extent to form the improved
13   calibration profile.

1   14. A method as recited in claim 13, further comprising
2   comparing the improved calibration profile to the initial
3   calibration profile to determine at least one occurrence
4   of a problem condition; and flagging said at least one
5   occurrence.

1   15. A method as recited in claim 14, further comprising
2   evaluating the flags of said at least one occurrence to
3   determine the usability of the improved calibration
4   profile.

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1 16. A method as recited in claim 13, wherein the
2 calibration profile is a white calibration profile.

1 17. A method as in claim 13, wherein the step of forming
2 extends a subset of the initial calibration profile by a
3 factor of four.

1 18. A system as in claim 1, wherein the calibration
2 image is obtained from chromalin paper.

1 19. A system as recited in claim 1, wherein the detector
2 is a CCD detector.

1 20. A system as recited in claim 1, wherein the
2 plurality of points are positions of pixels of the
3 calibation image, the calibration image having x rows of
4 pixels and y columns of pixels.

1 21. A method for developing a valid calibration profile
2 for a scanning system, the method comprising:

3   scanning an image to obtain the plurality of
4   calibration signals to an initial extent of the
5   image;

6   extrapolating the calibration signals to form
7   extended range signals;

8   applying multirate filtering to the extended
9   range signals to form a plurality of filtered
10   signals; and

11   truncating the plurality of filtered signals to

12   the initial extent to form said at least one

13   valid profile.

1   22. A method as recited in claim 21, wherein the at

2 least one valid profile includes both a white and a black

3 calibration profile.

1   23. A method as recited in claim 21, further comprising:

2   scanning an arbitrary image to obtain an

3   plurality of arbitrary signals; and employing

4   said at least one calibration profile to

5   correct the plurality of arbitrary signals.

1   24 An article of manufacture comprising:

2 a computer usable medium having computer readable program

3 code means embodied therein for causing the development

4 of a valid calibration profile for a scanning system, the

5 computer readable program code means in said article of

6 manufacture comprising computer readable program code

7 means for causing a computer to effect:

8   scanning an image to obtain the plurality of

9   calibration signals to an initial extent of the

10   image;

11   extrapolating the calibration signals to form

12   extended range signals;

13   applying multirate filtering to the extended

14   range signals to form a plurality of filtered

15   signals; and

16   truncating the plurality of filtered signals to

17   the initial extent to form said at least one

18   valid profile.

1   25.   An article of manufacture as recited in claim 24,

2   wherein the at least one valid profile includes both a

3   white and a black calibration profile.

1   26.   An article of manufacture as recited in claim 24,

2   further comprising computer readable program code means

3   for causing the computer to effect scanning an arbitrary

4   image to obtain an plurality of arbitrary signals; and

5   employing said at least one calibration profile to

6   correct the plurality of arbitrary signals

1   27.   A program storage device readable by machine,

2   tangibly embodying a program of instructions executable

3   by the machine to perform method steps for developing a

4   valid calibration profile for a scanning system, said

5   method steps comprising:

6   scanning an image to obtain the plurality of

7   calibration signals to an initial extent of the

8   image;

9   extrapolating the calibration signals to form

10   extended range signals;

11   applying multirate filtering to the extended
12   range signals to form a plurality of filtered
13   signals; and

14   truncating the plurality of filtered signals to
15   the initial extent to form said at least one
16   valid profile.

1   28. A program storage device readable by machine, as
2   recited in claim 27, wherein the at least one valid
3   profile includes both a white and a black calibration
4   profile.

1   29. A program storage device readable by machine,
2   tangibly embodying a program of instructions executable
3   by the machine to perform method steps for developing a
4   valid calibration profile for a scanning system, as
5   recited in claim 27, said method further comprising
6   scanning an arbitrary image to obtain an plurality of
7   arbitrary signals; and employing said at least one
8   calibration profile to correct the plurality of arbitrary
9   signals.

1   30. A system as recited in claim 8, wherein the
2   filtering includes multirate filtering.

1   31. A system as recited in claim 30, wherein the
2   multirate filtering.is repeated a number of times.

1   32. A method for scanning images, the method comprising:

2   providing a source of light;

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3   measuring at a number of points on a

4   transparent object, the intensity of light

5   emitted from the source of light transmitted

6   through the transparent object and forming a

7   first raw profile; and

8   smoothing the first raw profile to form a

9   calibration profile.

1 33. A method as recited in claim 32, further comprising:

2   measuring the intensity of light from the

3   source of light transmitted through an opaque

4   object at the number of points to form a second

5   raw profile; and

6   smoothing the second raw profile to form a

7   black calibration profile.

1 34. A method as recited in claim 32, further comprising:

2   measuring the intensity of light from the

3   source of light transmitted through a semi-

4   transparent object at the number of points to

5   form a semi-transparent object profile; and

6   correcting the semi-transparent object profile

7   using the calibration profile.

1 35. A method as recited in claim 34, wherein the

2 calibration profile is a white calibration profile, and

3 further comprising means for correcting the semi-

4   transparent object profile using the black calibration

5   profile.

1   36.   A computer program product comprising a computer

2   usable medium having computer readable program code means

3   embodied therein for causing images to be scanned, the

4   computer readable program code means in said computer

5   program product comprising computer readable program code

6   means for causing a computer to effect, the method

7   comprising:

8   providing a source of light;

9   measuring at a number of points on a

10   transparent object, the intensity of light

11   emitted from the source of light transmitted

12   through the transparent object and forming a

13   first raw profile; and

14   smoothing the first raw profile to form a

15   calibration profile

1   37.   A computer program product comprising a computer

2   usable medium having computer readable program code means

3   embodied therein for causing images to be scanned, as

4   recited in claim 36, wherein the calibration profile is a

5   white calibration program, and the computer readable

6   program code means in said computer program product

7   comprising computer readable program code means for

8   causing a computer to further effect the method

9   comprising:

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10      measuring the intensity of light from the
11      source of light transmitted through an opaque
12      object at the number of points to form a second
13      raw profile; and

14      smoothing the second raw profile to form a
15      black calibration profile.
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1   38.  A computer program product comprising a computer
2   usable medium having computer readable program code means
3   embodied therein for causing images to be scanned, as
4   recited in claim 36, the computer readable program code
5   means in said computer program product comprising
6   computer readable program code means for causing a
7   computer to effect the method further comprising:

8       measuring the intensity of light from the
9       source of light transmitted through a semi-
10      transparent object at the number of points to
11      form a semi-transparent object profile; and

12      correcting the semi-transparent object profile
13      using the calibration profile.
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1   39.  A computer program product comprising a computer
2   usable medium having computer readable program code means
3   embodied therein for causing images to be scanned, as
4   recited in claim 38, the computer readable program code
5   means in said computer program product comprising
6   computer readable program code means for causing a
7   computer to further effect the method comprising means
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8   for correcting the semi-transparent object profile using

9   the black calibration profile.

1   40.   A system as recited in claim 33, wherein the

2   calibration profile is a white calibration profile.

1   41.   A method for improving an initial calibration

2   profile having an initial profile extent to form an

3   improved calibration profile, the initial calibration

4   profile formed for a scanner employing a linear array CCD

5   and having a direction of motion, the method comprising:

6   applying multirate filtering to the initial

7   calibration profile so as to form a filtered

8   profile.

1   42.   A system for scanning images as recited in claim 9,

2   wherein the transparent object is air.

1   43.   A system as recited in claim 32, wherein the

2   transparent object is comprised of glass.

1   44.   A computer program product as recited in claim 36,

2   wherein the transparent object is air.

1   45.   A computer product as recited in claim 38, wherein

2   the transparent object is comprised of a glass base.

1   46.   A computer program product as recited in claim 36,

2   wherein the smoothing is comprised of filtering,

3   extrapolation and decimation.

1   47. A computer program product as recited in claim 46,

2   wherein the filtering includes multirate filtering.